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January 9, 2007

NIOSH Docket Officer, REFERENCE: NIOSH DOCKET-008
Robert A. Taft Laboratories M/S C34
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RE: September 19, 2006 (Draft for Discussion) Concept: Proposed Industrial Powered Air-Purifying Respirator (PAPR) Standard Concept, Docket-008

Dear Docket Officer:

3M Company (**3M**), through its Occupational Health and Environmental Safety (OH&ES) Division, is a major manufacturer and supplier of respiratory protective devices throughout the world. 3M has invented, developed, manufactured and sold approved respirators since 1972. We have developed numerous training programs, videos, computer programs and technical literature to help our customers develop and run effective respirator programs. Our sales people have trained and fit tested hundreds of thousands of respirator wearers throughout the world. Our technical staff has performed basic research on the performance of respirators and their uses, presented and published this data in numerous forums and participated in the development of the ANSI Z88 standards on respiratory protection. In sum, we have substantial experience in all phases and applications of respiratory protection. We are pleased to offer the following comments and recommendations regarding the Concept for Industrial Powered Air-Purifying Respirator (PAPR), dated September 19, 2006.

3M supports NIOSH in its effort to develop updated standards for evaluating the effectiveness of powered air purifying respirators for use in a variety of industrial environments.

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We appreciate the opportunity to add our comments and knowledge to the rulemaking record and look forward to the promulgation of a fair, protective and useful standard.

Sincerely,

Michael L. Runge
Technical Director
3M Occupational Health & Environmental Safety Division

Industrial PAPR Concept Dated September 19, 2006

General comments: Sections not mentioned below are supported by 3M as proposed. The Standard Testing Procedures (STP) must be linked to the test requirements in future concept papers. It is not possible to comment when they are not listed.

2. Definitions

2.2: Change "seals" to "is designed to seal." We suggest the requirement be revised to read:

> *(b) Tight-fitting PAPR - a PAPR which contains a respiratory inlet covering that is designed to seal to the face or neck.*

2.3: Eliminate "non-tight sealing" at the start of the definition and change "non-tight sealing" to "loose-fitting" before "facepiece." These mean the same thing, and the latter is an accepted industry term. It is not clear if a 'neck dam' referred to in 2.3.4 differs from what is usually called an inner shroud or bib. It appears a neck dam is not an inlet covering in itself, but rather a part of a loose-fitting inlet covering. We suggest the following revisions should be made to subparagraphs 2.3.1-2.3.4:

2.3.1: Hood-a **flexible** loose-fitting. . .
2.3.2: Helmet-change "non-flexible" to "rigid." The portions of the user covered by the helmet should be stated

- 2.3.3: Loose-fitting facepiece, second sentence-It does not cover the neck, **the back of the head** or shoulders. Add sentence: It may or may not offer some degree of impact and penetration protection of the head.

2.3.4: Begin the definition with "a part of a loose-fitting. . ." Add phrase "Also referred to as an inner shroud or inner bib."

We believe the entire revised paragraph should read:

> *2.3 Loose-fitting PAPR- a PAPR which contains a respiratory inlet covering that may contact but does not seal completely to the face or neck. It may consist of a hood, helmet, or loose-fitting facepiece.*
>
> > *2.3.1 Hood - a flexible loose-fitting respiratory inlet covering that covers the head and neck. It may also cover portions of the shoulders.*
> >
> > *2.3.2 Helmet - a rigid loose-fitting inlet covering that is designed to offer some degree of impact and penetration protection of the head. It covers the head and neck and may cover portions of the shoulders.*
> >
> > *2.3.3 Loose-fitting facepiece - a loose-fitting respiratory inlet covering which makes contact with but does not seal to the face. It does not cover the neck, back of the head or shoulders. It may or may not offer some degree of impact and penetration protection of the head.*

2.3.4 Loose-fitting neck dam- a part of a loose-fitting respiratory inlet covering which makes contact with but does not seal to the neck. Also referred to as an inner shroud or inner bib.

2.5: Delete 'tight fitting' from the definition. We suggest the paragraph be revised to read as follows:

2.5 Chemical cartridge and/or filter PAPR - A PAPR which contains an appropriate cartridge and/or PAPR filter suitable for its intended use and not intended to be used for escape from atmospheres that may be IDLH.

2.6: The definition appears to be incomplete. Insert "A PAPR that provides protection from . . ." at the beginning of the first sentence. The revised definition would then read:

2.6 CBRN Protection - Chemical, Biological, Radiological, and Nuclear. "A PAPR that provides protection from a detailed list of chemicals, including chemical warfare agents, biological agents and radiological agents that have been represented by testing against the 10 Test Representative Agents (TRA), dioctyl phalate (DOP) and Live Agent Testing (LAT).

2.7: Delete "loose-fitting" from the definition; some end users may want tight-fitting devices for the lower level conditions. The definition would then read:

2.7 LCBRN - Lower level Chemical, Biological, Radiological, and Nuclear. A PAPR that meets the additional minimum requirements defined herein for LCBRN.

3 Descriptions

3.1: Not all particulate atmospheres have both solid and liquid contaminants. Please insert "/or" as shown below:

3.1 PAPR utilizes a powered mechanism to force ambient air through an air-purifying element(s) to remove contaminants from the ambient air. It is designed for use as respiratory protection against atmospheres with solid and/or liquid contaminants (e.g., dusts, fumes and/or mists), gases and/or vapors where the concentrations during entry and use are not immediately dangerous to life or health (IDLH). *All are considered as positive pressure when tested by air flow testing described herein.*

3.2: For consistency with 2.4, "full facepiece" should be deleted and PAPR95 should be added. We recommend the revised definition read as follows:

3.2 Gas Mask PAPR is a tight-fitting PAPR equipped with appropriate canisters. May also contain PAPR100 or PAPR95 filters and be designed to operate in a silent mode as defined herein. They may be used for escape from hazardous atmospheres containing a minimum of 19.5% oxygen to support life.

3.2.1 CBRN PAPR is a tight-fitting PAPR meeting the additional requirements for CBRN protection.

3.2.2 and 3.2.3: LCBRN should not be listed as a type of gas mask. It should be a separate paragraph 3.3. "Loose-fitting" should be removed from the definition, and a sentence added to indicate they are not for escape from hazardous atmospheres that are IDLH. 3.2.3 should be redesignated as 3.4. The revisions would then read as follows.

3.3 LCBRN PAPR is a PAPR meeting lower level CBRN additional requirements described herein. They are not acceptable for escape from hazardous atmospheres.

3.4 Half-mask PAPR will not be approved for CBRN protection.

4.1 Non-Respiratory Requirements

4.1.1 Required Components

Item (7) should be revised to say "low flow and/or low pressure indicator." Either can be used to warn the user when the PAPR is no longer performing at its certified performance level. Our logic for this statement is fully explained in our comment to 4.1.2.2 below.

4.1.2 General Construction

4.1.2.1: This paragraph should be revised to indicate that a full charge indicator need not be located on the battery itself. For example, the full charge indicator can be located on the charger. Also, as we describe in our comments to 4.1.2.2 and 4.1.10.1, real time power indication is not necessary to protect the user. We suggest the requirement be revised to read:

4.1.2.1 Each PAPR system shall have an indicator to indicate when the battery is fully charged.

4.1.2.2: PAPRs should not be treated as SCBA. Since PAPRs are intended for routine use in atmospheres that are not IDLH, there is no compelling reason to require alarms; they should be optional at the manufacturer's discretion. The statement should also be revised to indicate that if an alarm is used, it may actuate based on either low flow or low pressure. The two are inter-related; pressure in the inlet covering is maintained by providing appropriate air flow. Further, it is known that most, if not all, positive pressure

respirators can be drawn into momentary negative pressure excursions in actual use. There are laboratory studies[1,2] and field studies[3] that have measured these excursions. When the data from these studies are analyzed, it is easily seen that the occasional negative pressure excursions that occur in positive pressure respirators have negligible effect on protection, even during periods of heavy work. Campbell et al.[3] demonstrated this with a mathematical model; Cohen et al.[2] measured simulated workplace protection factors (equivalent to LRPL) far in excess of 10,000 for all but one device. Therefore, an alarm that actuates after one or a few momentary negative pressure excursions is not useful. It does not tell the user he or she may be at risk of possible reduced protection because of declining PAPR function. The permissible response time for the low pressure indicator must be specified to prevent spurious alarming. To provide PAPR wearers useful information, we suggest an alarm that actuates when airflow falls below the manufacturer's stated minimum for 30 seconds. This would address several failure modes, including clogged filters, low battery and motor degradation. We suggest the requirement be revised to read:

> *4.1.2.2 If a PAPR is equipped with an alarm, it shall alert the user, via a readily visible light or other means, when the airflow of the PAPR falls below the manufacturer's stated minimum design flow (MMDF) 30 or more seconds. It shall be readily detectable to the wearer during use without manipulation of the respirator. Indicators that are actuated when pressure inside the respiratory inlet covering falls below the manufacturer's stated minimum for 30 or more seconds are also acceptable.*

4.1.2.5: Delete the phrase "or most recent version;" the sentence should be ended after "2003." If Z88.7 is revised, NIOSH can choose to incorporate it (or not) with appropriate public notice. We suggest the sentence be revised to read:

> *4.1.2.2 Color coding of cartridges and canisters shall be per the ANSI Z88.7 - 2003.*

4.1.2.8: While devices will almost certainly be configured this way, this is a design specification and should be deleted.

4.1.5 Head Harness

4.1.5.1: This is a design specification and should be deleted. It is possible that not all devices will have a head harness. We suggest the sentence be revised to read:

> *4.1.5.1 If the respiratory inlet covering is equipped with a head harness, it shall be designed and constructed to hold the unit properly in place, provide adequate tension during use, and provide even distribution of pressure over the entire area in contact with the head or face.*

4.1.6 Respiratory Inlet Coverings

4.1.6.4: Users should know whether or not a helmet or loose-fitting facepiece provides protection against impact and penetration. We suggest adding this requirement as 4.1.6.5 and renumbering the next paragraph as 4.1.6.6. We believe the added provision should read:

> *4.1.6.5 Helmets designed for head protection shall meet the requirements of ANSI Z89.1-2003 Type I or Type II. Helmets not designed to provide head protection shall be prominently and permanently labeled to indicate that they are not impact and penetration resistant.*

4.1.7 Eyepieces/Lenses of Respiratory Inlet Coverings

4.1.7.3: This requirement is vague and the test must be defined. Suggest replacing the phrase "as a result of normal operation" with "during the Total Inward Leakage test specified in 4.2.10." The revised paragraph would then read:

> *4.1.7.3 Lenses, including visors and shields, will not fog during the Total Inward Leakage test specified in 4.2.10.*

4.1.7.4: Delete the phrase "or most recent version;" the sentence should be ended after "2003." If Z87.1 is revised, NIOSH can choose to incorporate it (or not) with appropriate public notice. We also believe that marking lenses that are not impact resistant would conflict with Z87.1, which requires marking to identify compliant eye and face protection. Cautionary language in the user instructions will tell users if the lens does not offer eye or face protection. We believe the revised sentence should read:

> *4.1.7.4 Lenses designed to provide eye and/or face protection shall meet the requirements of ANSI Z87.1- 2003.*

4.1.9 Low Flow Indicator

This heading should be retitled **Low Flow or Low Pressure** Indicator since either should be permissible.

4.1.9.1: For clarity, we suggest adding a phrase stating positive pressure is to be maintained during the NIOSH testing to the definition. The revised provision would then read:

> *4.1.9.1 Either a low flow or pressure indicator should be present. The purpose of this indicator is to alert the user when the system is not performing as intended. It will actively and readily indicate when either:*

The airflow is lower than the MMDF (Manufacturer's Minimum Design Flow) for 30 seconds or more, as tested in the flow determination test; or
the pressure inside the respiratory inlet covering is below ambient pressure for 30 seconds or more with the blower operating during airflow testing described herein.

4.1.10 Power Indicator

4.1.10.1: PAPRs should not be treated as SCBA. They are intended for routine use only in atmospheres that are not IDLH. For this reason respiratory protection is not necessary for egress when chemical cartridge PAPRs are used. If the atmosphere may become IDLH, tight-fitting canister PAPRs must be selected and will provide the necessary protection for escape in its negative pressure (silent) mode. In addition, significant reduction in or complete loss of power will reduce both flow and pressure in the respiratory inlet covering, triggering the low flow or pressure alarm. Thus, there is no compelling reason to require such power indicators; they should be optional at the manufacturer's discretion. We believe the revised sentence should read:

4.1.10.1 Power for PAPR can be supplied by local battery or external power supply.

4.1.10.2: A power indicator on the battery charger should be permissible since it can accomplish the stated purpose. As noted in our comment to 4.1.10.1, real-time power indication is not necessary. We suggest the provision be revised to read:

4.1.10.2 Each PAPR equipped with a battery will have an indicator on the PAPR or its battery charger to show when the power is full.

4.1.10.3 and 4.1.10.4: As noted in our comment to 4.1.10.1, real-time power indication is not necessary nor does it add to the user's protection. If the low flow or pressure requirement is maintained, we recommend that these criteria be removed.

4.1.11 Battery Life

4.1.11.2: It is not appropriate to test every PAPR with the lowest resistance filtering elements since they may not present the maximum challenge to the battery. We believe the sentence should be revised read:

4.1.11.2 The PAPR system shall be operated fully assembled on a headform using the combination of air purifying elements and inlet covering specified by the manufacturer to maximize the severity of the challenge to the battery.

4.1.11.3: According to 4.1.11.2, it appears that all PAPR will be tested on a breathing machine. If so, "For Breath Responsive PAPR" should be deleted. The breathing

machine operating conditions should also be specified. We assume "described in this part" means according to 4.2.4. If so, the revised paragraph should read:

4.1.11.3 A breathing machine as described in 4.2.4 will be used.

4.1.11.5: Consistent with our earlier comments, we believe flow and pressure are equally valid indicators that a system is performing as intended. As such, either can be used to assess battery life. We suggest giving manufacturers the choice of test to be done, as follows:

4.1.11.5 At no time will the pressure, when measured in the area of the nose and mouth, drop below ambient during testing; or
at no time will the flow through the PAPR fall below the MMDF (manufacturer's minimum design flow). The manufacturer will specify the test desired for their system. All tests will be performed on a breathing machine (4.2.4) at the desired flow rating.

4.1.12 End of Service Life (ESLI) Criteria

4.1.12.1.1: The meaning of "fully indicates" is not clear. Suggest rewording the provision as follows:

4.1.12.1.1 Demonstration that the ESLI is at its end point, (e.g., color change is complete, warning signal activates, etc.) when the cartridge or canister has at least 10% of its service life remaining.

4.1.12.1.2: Adsorption of the impregnating agent has no effect on the user or the performance of the device. Desorption could potentially harm the user if it were a toxic material. Thus, "adsorption" should be changed to "desorption." We suggest the requirement be revised as follows:

4.1.12.1.2 Desorption of any impregnating agents used in the indicator.

4.1.12.1.3: The meaning of this provision is not clear. Suggest rewording the provision as follows:

4.1.12.1.3 Chemicals that could cause the ESLI to malfunction if they are commonly found in workplaces where it is anticipated that a given ESLI will be used.

4.1.12.1.4: The meaning of this provision is not clear. Many gases are removed by chemical reaction with the sorbent. Further, this information is not required for cartridges and canisters without ESLI. Therefore, if the intent of the requirement is to determine if something in the ESLI might react with the contaminants and produce a potentially hazardous exposure for the user. We suggest rewording the provision as follows:

4.1.12.1.4 Any potentially hazardous exposures resulting from the reaction of the ESLI and the gases and/or vapors the air purifying element is designed to remove.

4.1.12.1.5: It is also important to specify permissible storage conditions. Suggest revising as follows:

4.1.12.1.5: The shelf (storage) life of the ESLI, if any, and permissible storage conditions, e.g., temperature, humidity, etc.

4.1.12.1.6: The two contaminant levels must be specified, and allowance made for ESLI that might be used for more than one contaminant. We recommend the following revision:

4.1.12.1.6: The data will include flow-temperature results at minimum and maximum recommended flows and temperatures of the PAPR system, at 25% and 80% RH, and at contaminant levels equal to the Federal OSHA permissible exposure limit and 1000 times that concentration of each contaminant for which the ESLI will be used.

4.1.12.2.1: It may be necessary to perform some repositioning of the PAPR to allow the user to clearly see the ESLI. For example, a belt-mounted PAPR may need to be repositioned on the user's waist. So long as these minor movements would not compromise the PAPR function or user protection, they should be permitted. We suggest the requirement be revised to read:

4.1.12.2.1 A passive ESLI shall be situated on the respirator so that it is readily visible by the wearer without manipulation of either the respirator or the indicator that would affect the protection of the user or interfere with PAPR function.

4.1.12.2.2 It may not be possible to anticipate all possible color blindness combinations potential users may have. Manufacturers should be required to determine if common color blindness conditions (red-green and yellow-blue) might be a contraindication for use of their particular ESLI. Potential problems can be listed in the user instructions. It is the end-user employer's responsibility to determine via the medical evaluation program which employees should not wear respirators with specific ESLI because of color blindness. We suggest the requirement be revised to read:

4.1.12.2.2 If the passive ESLI relies on a color change that may be hard to detect by individuals with the most common forms of color blindness (red-green and yellow-blue), *the manufacturer shall include an appropriate warning in the user instructions.*

4.1.12.2.3: The requirement for the initial color of ESLI is not necessary and should be deleted. It does nothing to help the user determine when service life has been reached. NIOSH has previously waived this requirement for mercury vapor cartridges (12-29-05

memo from Doris Walter of NPPTL to Martha Nelson of 3M). We suggest the sentence be revised to read:

> *4.1.12.2.3 If the passive indicator utilizes color change, the reference color for the final (end point) color of the indicator shall be placed adjacent to the indicator.*

4.1.12.3.4: This requirement needs clarification. ESLI are typically not designed for cleaning, a fact which can be stated in the user instructions. We suggest the requirement be revised as follows:

> *4.1.12.3.4 Any ESLI that is permanently installed shall withstand a drop from a 2 meter height onto concrete.*

4.1.12.3.7: The terms "false positive" and "false negative" are ambiguous. The following clarification is recommended:

> *4.1.12.3.7 PAPR with an ESLI will be labeled appropriately to adequately inform the user of use conditions and of any situations that could cause the ESLI to fail to respond properly to the contaminant(s) for which it will be used.*

4.1.15 Failure Mode and Effects Analysis (FMEA)

4.15.2: We reserve comment on this provision until the expected content of the summary and Annex X are made available.

4.2 Respiratory Requirements

4.2.3 Breathing Resistance

4.2.3.1: It appears the intent is to test breathing resistance on a breathing machine, but it is not clearly stated. We recommend the following revision:

> *4.2.3.1 Exhalation breathing resistance may not exceed 25.4 mm (1") water gauge above static at any flow rate with the respirator operating on a headform connected to a breathing machine as described in 4.2.4. The static reference point is defined as the point of no air flow, between inhalation and exhalation breaths.*

4.2.4 Air flow determination: Blowers Speeds are Low, Moderate, and High work rates.

It is our understanding from comments at the October 12 public meeting that NIOSH might consider a positive pressure criterion as an alternative to specific flow rate requirements. That is, if the device maintains positive pressure during testing at the

requested flow rating, it would be acceptable regardless of the airflow rate. We support this approach; either airflow or positive pressure testing should be permitted in this section.

4.2.4.1: The words "maintained blower speed" are ambiguous and should be removed. We are not of the opinion that all single power units should be moderate work rate, and suggest removing this provision. The recommended revisions would result in the following:

> *4.2.4.1 Single power blower units. These are blower units that have a single "On/Off" switch and use one blower setting.*

4.2.4.1.1 and 4.2.1.2: If single power units can be approved at all three work rates as we have suggested, these two paragraphs are unnecessary and should be deleted. All PAPR can be tested under the appropriate criteria under 4.2.4.2.

4.2.4.2.2: There is no reason to exclude tight-fitting, low flow PAPR. It is also not clear that the flow rates specified in the entire section are minimum (as opposed to an exact) average flow rates. Use of a breathing machine is implied but not specified. We suggest replacing the current statement with the test conditions for this approval. We suggest the following:

> *4.2.4.2.2 Tight-fitting PAPR Moderate flow rating must maintain an average minimum airflow of 60 Lpm during the manufacturer minimum service life time while mounted on a headform mounted on a breathingmachine set at a simulated rate of 21 Lpm (1.2 Liters @ 17.5 respirations/min).*

4.2.4.2.3 through 4.2.4.2.8: For clarity, please reword as indicated above in 4.2.4.2.2.

4.2.4.2.9: In our opinion the Breath responsive, loose-fitting PAPR describes an impossible design. We suggest deleting this provision.

4.2.5 Breathing Gas: Carbon dioxide (CO2) Machine Tests

4.2.5.2: This requirement needs clarification. It appears it is only applicable to variable power units. If so, the following revision is suggested:

> *4.2.5.2 This test will be conducted with the PAPR blower operating at the minimum air flow rate specified by the manufacturer for variable power PAPR and, for silent mode PAPR, with the blower not operating. Single power blower units will be tested at their minimum average airflow.*

4.2.6 Service Time Limitations

4.2.6.3: We believe that for consistency with 4.1.11.2, "with the highest resistance combination of cartridges, canisters and/or filters should be replaced with "the combination of air purifying elements and inlet covering specified by the manufacturer to maximize the severity of the challenge to the battery." The revised requirement would then read:

> *4.2.6.3 Battery service times will be such that batteries will perform properly and meet testing requirements for the entire stated battery operational service time at the lowest recommended operating temperature specified by the applicant and with the combination of air purifying elements and inlet covering specified by the manufacturer to maximize the severity of the challenge to the battery.*

4.2.7 Chemical Cartridge/Canister Gas/Vapor Removing Effectiveness

4.2.7.3: We believe the flow rate values referred to are continuous flow, but it is not stated. We suggest the following revision:

> *4.2.7.3 Continuous air flow rates required for testing are given in Table 1.1 depending on the type of respirator and the work rating of the respirator. For PAPR with two or more canisters, canisters will be tested at the required flow divided by the number of canisters.*

The table on the top of page 16 (Table 1.1, we believe) needs a title.
"Not applicable" in column 2, 3 should be changed to 60 Lpm
The flow rates for "Constant Flow: High" should be 250 and 370 for consistency with 4.2.4.2.4 and 4.2.4.2.8.

4.2.7.4: Carbon monoxide approval should be available for both cartridge and canister PAPR.

4.2.7.8.1: The IDLH values NIOSH will use to make this determination must be specified by a reference. We suggest the revised sentence read as follows:

> *4.2.7.8.1 For gases under this paragraph (d) the canister test concentration calculation shall generally be set at the IDLH concentration listed in NIOSH Publication No. 2005-149 multiplied by 1.5.*

4.2.7.8.5: The breakthrough concentrations should be stated as a percentage of the challenge concentration. This approach would conform to the way that laboratory test data are typically reported. It would also minimize the misconception of some end users that the bench tests are related to exposure limits. We suggest the requirement should be revised to read:

4.2.7.8.5 Allowable breakthrough concentrations for all testing for which approval is sought shall be set at 1% of the challenge concentration.

4.2.7.9.1: The IDLH values NIOSH will use to make this determination must be specified by a reference. In addition, since canisters may actually be used for escape from IDLH conditions, it would be prudent to use a higher multiplier. We suggest the revised sentence read as follows:

4.2.7.9 For gases under this paragraph (d) the canister test concentration calculation shall generally be set at the IDLH concentration listed in NIOSH Publication No. 2005-149 multiplied by 5.

4.2.7.9.6: Because exposure limits may change, the breakthrough concentrations should be stated as a percentage of the challenge concentration. This approach would conform to the way that laboratory test data are typically reported. It would also minimize the misconception of some end users that the bench tests are related to exposure limits. We believe the requirement should be revised to read:

4.2.7.8.5 Allowable breakthrough concentrations for all testing for which approval is sought shall be measured at 1% and 10% of the challenge concentration.

4.2.9 Breathing Gas: Oxygen and Carbon Dioxide Human Subject Generated

It is redundant to perform two carbon dioxide tests. We suggest either deleting the test in 4.2.5, or adding an oxygen test to 4.2.5 and eliminating 4.2.9.

4.2.10 Total Inward Leakage

4.2.10.1: It appears that the blower is to be running during this test, but the paragraph does not say so. We suggest adding that statement for clarity. Additionally, the number of test subjects and the percentage required to achieve the stated TIL values should be added. The revised paragraph would then read:

4.2.10.1 The measured Total Inward Leakage (TIL) will be determined for each PAPR design with the blower operating and the device equipped with the heaviest available cartridges, canisters, and accessories. TIL values are listed in Table 5 and must be achieved by 11 of 12 test subjects.

Table 5: The values expressed are not TIL values; they are LRPL values. The heading of the second column could be changed to reflect this, or the values could be changed to maximum TIL of 1%, 0.4% and 0.01%. Also, hoods and helmets are not mentioned in the table. We suggest including them with the tight-fitting facepieces, i.e., TIL value of 0.01%.

5. Application-Specific Requirements - Performance Requirements Beyond Base

5.1. CBRN Responder Requirements.

Suggest changing "have" to "meet" as follows:

> *5.1 Respirators used for responding to CBRN events must meet the following requirements*

5.2 LCBRN Receiver Requirements. Respirators Used for Lower Level CBRN Event:

5.2.1 and 5.2.2 are not necessary since they are both covered under the general requirements. There is also no reason to change the TIL criterion. Please delete both.

5.2.3.1 Chemical Agent Permeation and Penetration Resistance against Distilled Sulfur Mustard (HD) and Sarin (GB) Agent Requirement

The second footnote to Table 4 appears to be unnecessary since only a vapor challenge is called for in the table.

5.2.4 Cartridge Test Challenge and Test Breakthrough Concentrations

5.2.4.1: The words "cartridge" and "canister" are used interchangeably in this section. It appears that "cartridge" is the correct term. We recommend the following wording:

> *5.2.4.1 The gas/vapor test challenges and breakthrough concentrations shown in Table 1: Cartridge Challenge, Breakthrough Concentrations, and Cartridge Efficiency will be used to establish the cartridge service life.*

> ***Table 1.-- Cartridge Test Challenge and Test Breakthrough Concentrations***

5.4 Hospital PAPR – TBD

5.5 Clean Room – TBD

5.6 Welding – TBD

5.7 Multifunction – TBD

5.8 Police/Special operations

General comment on the application specific PAPRs listed above: We believe that creating multiple new categories of PAPR is unnecessary and could be confusing and detrimental to end users. For example, selecting a PAPR approved for welding applications may cause the employer to not take into consideration exposures to other

contaminants in the work area that may require something more than just a welding PAPR. The industrial PAPR, CBRN PAPR and LCBRN PAPR categories provide sufficient flexibility for manufacturers and end user applications. Specific features can be added by manufacturers as user demand requires, but it is not necessary to develop regulatory criteria.

5.11 Air Flow Determination for maintaining Positive Pressue

5.11.1: If these provisions are maintained "during operation" they should be changed to "during NIOSH testing" for clarity. "Facepiece" should also be revised to include all respiratory inlet coverings. The revised sentence would then read:

> *5.11.1 Positive pressure PAPR will maintain a pressure above ambient inside the respiratory inlet covering during NIOSH testing.*

References

1. Burgess JL, Crutchfield CD (1995) Quantitative respirator fit tests of Tucson fire fighters and measurement of negative pressure excursions during exertion. Appl Occup Environ Hyg 10(1):29-36.

2. Cohen HJ, Hecker LH, Matthies DK, Johnson JS, Bierman AH, Foote KL (2001) Simulated workplace protection factor study of powered air-purifying and supplied air respirators AIHAJ 62(5):595-604.

3. Campbell DL, Noonan GP, Merinar TR, Stobbe JA (1994) Estimated workplace protection factors for positive-pressure self-contained breathing apparatus. Am Ind Hyg Assoc J 55(4):322-329.